New Modelling Approaches

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ABSTRACT

New wireless technologies are being introduced and public concerns about possible health effects due to the everyday exposure to radio-frequency electromagnetic fields (RF-EMF) are increasing. Therefore, new exposure assessment methods are needed. In this abstract we will discuss surrogate modelling as a way to create heat maps [1] and indoor network planning accounting with downlink and uplink exposure [2].

A novel methodology is proposed to create heat maps that accurately pinpoint the outdoor locations with elevated exposure to radio-frequency (RF) electromagnetic fields (EMF) in an extensive urban region (or, hotspots), and that would allow local authorities and epidemiologists to efficiently assess the locations and spectral composition of these hotspots, while at the same time developing a global picture of the exposure in the area. Moreover, no prior knowledge about the presence of RF radiation sources (e.g., base station parameters) is required. After building a surrogate model from the available data using kriging, the proposed method makes use of an iterative sampling strategy that selects new measurement locations at spots which are deemed to contain the most valuable information – inside hotspots or in search of them – based on the prediction uncertainty of the model.

Most currently available network planners do not predict or account for human exposure to radio-frequent sources. This presentation therefore proposes the first heuristic network calculator for both whole-body exposure due to base stations or access points (downlink exposure) and localized exposure due to the mobile device (uplink exposure) in indoor wireless networks. Exposure values are calculated and compared for three phone call scenarios (Universal Mobile Telecommunications System (UMTS) macrocell, UMTS femtocell, WiFi voice-over-IP) with respect to the electric-field strength and localized Specific Absorption Rate (SAR) distribution, based on successfully validated prediction models. The benefits of the UMTS power control mechanisms are demonstrated. Exposure doses are compared for the three scenarios and two phone call duration patterns, confirming the advantages of femtocell deployments in indoor environments.

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REFERENCES

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